City of Corvallis Salmon Response Plan

Chapter 7. Proposed Limit 12 Program Solutions

Prepared for:

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DISCLAIMER

The authors have attempted to replace all references to Squaw Creek with the creek's new name, Dunawi Creek. This includes replacing the creek's full name as well as changing Squaw Creek Reach reference labels to indicate Dunawi Creek.

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CHAPTER 7. PROPOSED LIMIT 12 PROGRAM SOLUTIONS

INTRODUCTION

Based on the analysis of impacts to Chinook salmon habitat and water quality from City of Corvallis activities and citizen behaviors, which is described in the previous chapter, the City has proposed solutions that prevent future habitat degradation and initiate restoration of PFC. When combined into a single program the proposed solutions meet the intent of the ESA Section 4(d) Rule Limit 12 (Municipal, Residential, Commercial, and Industrial Development and Redevelopment) objectives.

This chapter identifies the proposed solution options. It describes the process used to identify solution options, the justification for the solutions, the solution option refinement process, and the list of solution options. It details each solution and the impacts they are designed to address. It also identifies which Limit 12 criterion the selected solution will meet since most individual solutions do not meet all 12 considerations listed under Limit 12 of the 4(d) Rules (see Appendix 1 for the NOAA Fisheries guidance binder on 4(d) Rules compliance).

It is important to emphasize, however, that the program solutions have not been finalized. Other City environmental, planning and program activities identified in previous chapters are still under development (e.g., Goal 5 process Natural Features Inventory, stormwater management implementation program, Comprehensive Plan and LDC updates). It is the City's intention to integrate the ESA Salmon Response Plan program solutions into the City's practices, policies and codes as they are modified through these processes.

SOLUTION OPTION IDENTIFICATION PROCESS OVERVIEW

The following is an overview of the process used to identify the solution options. It begins with an evaluation of the impacts from City activities and citizen behavior on Chinook salmon habitat/water quality. This involves the determination of the relative impact and ranking of the activities and behaviors on habitat done with the weighted database. It is followed by solution option identification where the project team and the community developed solution options that prevent future habitat degradation and initiate restoration of PFC. An important part of the options development process is the extensive refinement that involved stakeholders and the public. The process overview concludes with a brief discussion of how the final set of solution options was selected.

Identifying and Ranking City Activity and Citizen Behavior Impacts

The identified solution options resulted from the integration of the baseline conditions database and pathways database developed in Phase I into a single relational database in Phase II. Weighting factors were developed because different City activities and behaviors have relatively different impacts on Chinook salmon habitat. These weighting factors, when applied to City activities and citizen behaviors, allowed the project team to analyze the spatial distribution and relative differences of impact that City activities and citizen

behaviors have on Chinook salmon habitat/water quality. The project team found that the impacts ranged from positive (decreased or prevented habitat degradation) to negative (increased habitat degradation).

Since the purpose of the project is to prevent habitat degradation, attention was focused on those activities and behaviors that negatively impact Chinook salmon habitat and water quality. Using the database it is then possible to identify not only which activity and behavior negatively impacts Chinook salmon habitat and its distribution (reach, stormwater basin, creek, citywide, and UGB), but it is also possible to determine the relative negative impact of the activity as well.

A rank-ordered list was developed that grouped together activities and behaviors with similar weighted scores. Those with higher negative scores were considered to have a greater negative impact on Chinook salmon habitat and from a policy standpoint were presumably of higher priority to correct than other activities and behaviors with lower negative scores.

An extensive review process was used to ensure the accuracy of the list and ranking. The review process included an internal project team review as well as a peer review process with the Technical Advisory Committee (TAC). Where necessary, refinements, modifications and corrections were made to the database to better reflect the impact of the City activity and citizen behavior.

Finally, the activities and behaviors were compared to a set of criteria to determine their relative impact to Chinook salmon habitat and water quality based on their magnitude, timing and intensity. A number that best represented the activity's magnitude, timing and intensity was assigned to the activity and behavior. These numbers were summed and then multiplied by a number that represented their location inside or outside the 200-foot study corridor. Activities were then ranked according to their final score, which represented the activity's impact to Chinook salmon habitat and water quality (see previous chapter for detailed discussion of this evaluation process).

Solution Options Identification Process

After review of the ranked order of activities and citizen behaviors, the project team began the solution option identification process. This process was completed in three steps – 1) selecting activities with the greatest negative values, 2) evaluating potential adjustments or changes to selected activities, and 3) developing solution options.

Select Activities

The City activities that contribute to Chinook habitat and water quality degradation come primarily from City Departments responsible for parks and recreation, transportation, utilities, and land use planning. They cover land development, roads, buildings, pipeline construction and utility service facilities, as well as the operation and maintenance activities to service and maintain them. Planning policies, along with the supporting LDC,

are the guidelines and directions for the City's growth and development and the public services that are needed to support it.

The first stage in the selection process was to identify those activities with the greatest negative score. The team reviewed all activities with negative scores. There were 1,710 records with negative scores ranging from -1 (least negative impact on Chinook salmon habitat and water quality) to -60 (highest negative impact on habitat and water quality). The initial determination was to include all activities with negative scores. The rationale to do so was based on the idea that in the initial screening it would be important to recognize that all negative scores indicated that the activity had a negative impact on habitat and water quality. In later stages of the screening process, there would be an opportunity to screen out activities with a lesser negative impact and focus on those that had a greater impact on habitat and water quality.

The second stage was to organize the records in a way that would be useful for developing solution options. Since there were so many records it was necessary to create practical categories for solution development. One way was to group them by similarity (e.g., purpose, function, department, etc.) since many of the records in the database covered a specific detail or single aspect of the same activity. The following categories were used to group the activities:

- Land use
  - Zoning
  - Land Development Code
- Parks and recreation
  - Planning and design
  - Capital improvements
  - Operation and maintenance
- Stormwater
  - Operation and maintenance
  - Run-off collection, treatment, and discharge
  - Capital improvements
- Construction of public projects
  - On-site construction requirements
- Transportation
  - Operation and maintenance
  - Capital improvements

- Water supply
  - Operation and maintenance
  - Capital improvements
- Wastewater treatment
  - Operation and maintenance
  - Capital improvements

The citizen behavior activities were organized differently. Similar activities were categorized based on whether they were indoor or outdoor, landscape or other maintenance. The citizen behavior activities were grouped in the following manner:

- Household
  - Indoor cleaning and upkeep
- Outside
  - Yard maintenance
  - Landscaping
  - Other outdoor maintenance other than yard.

Develop Solution Options

Once the records were organized according to the categories, a third stage was initiated to identify solution options. The initial screen involved examining each category to determine whether there were already other programs underway or planned that could also address the project's Chinook salmon habitat and water quality issues. If so, the project would avoid any overlapping and duplication of effort by simply contributing to these ongoing or planned programs.

The screening discovered several programs currently in various stages of development and implementation that did have some overlap with the existing ESA categories. They included the following:

- Statewide Goal 5 Inventory (Natural Resource, Scenic and Historic Areas and Open Space Goal – OAR 660-015-0000(5))
- Land Development Code update (Phase II)
- Stormwater Master Plan implementation

Where ESA categories matched other programs, the project team reviewed them to identify how well they considered ESA issues and to identify where additional ESA recommendations could be made to the existing program. ESA categories that did not

match ongoing efforts were considered wide open to begin to develop options targeted to specifically address Chinook salmon habitat and water quality.

First Solution Option Identification

The first cut at solution options identification was unconstrained by cost or other parameters. This allowed for the most creative and far-reaching possibilities to be explored. In a number of instances elements of an option that would otherwise not have been identified were selected and incorporated into the viable options.

The following is a summary of the options identified in this first screening.

- Land Use.
  - Create new zoning categories (e.g., stream corridor, conservation open space).
  - Fully protect portions of the stream corridor that are deemed Significant Natural Features.
  - Support LDC updates to incorporate Chinook salmon habitat protection design standards.
  - Prevent any future development within the 100-year flood plain and provide incentives to remove existing development within the 100-year flood plain.
  - Contribute to the City's effort to meet Statewide Goal 5 planning requirements with Chinook salmon habitat data and protection options.
  - Ensure consistency with other planning efforts (e.g., parks and recreation planning, utility master planning, transportation planning).
  - Incorporate planning concepts that reduce transportation trip generation and need for more roads (e.g., mixed use, higher residential density, alternative transportation modes, etc.).
- Parks and Recreation.
  - Design future parks and open space facilities to consider site location and incorporate "fish-friendly" elements (stream corridors, riparian areas, connectivity, vegetation, etc.).
  - Inventory parks facilities to assess how they currently fit ESA goals and identify and design modifications to meet these goals where they do not.
  - Partner with non-profit organizations to purchase and set aside land to meet ESA goals.
  - Prepare an Operations and Maintenance Manual outlining operations and maintenance for each park.
  - Site wood chip pile elsewhere with appropriate run-off controls in place and do not accept third party organic debris.

- Stormwater.
  - Incorporate stormwater protection criteria into the LDC and Design Criteria Manual.
  - Incorporate erosion control requirements into the LDC for public and private projects.
  - Implement applicable master plan recommendations to meet ESA goals.
  - Develop operations and maintenance manual that incorporates ESA goals.
- Public Construction.
  - Require waste materials disposal plan for approval by City construction engineer.
  - Require City to monitor construction site for construction activities that can degrade Chinook salmon habitat and water quality.
  - Memorialize changes in site construction requirements through city ordinance.
  - Add requirements in the Standard Construction Specifications (SCS) for construction site activities including the recycling of construction site materials, prohibiting clean-up activities (e.g., concrete wash down and disposal, asphalt clean up, etc.), de-chlorination, dewatering, erosion control, eco-friendly construction materials, etc.).
  - Strive to meet Leadership in Energy & Environmental Design (LEED) standard specifications for City buildings (City is currently reviewing specs for compatibility and practical use).
- Transportation.
  - Incorporate ESA goals into future transportation planning activities (e.g., adapt "green streets" concepts, transportation demand management, non-motorized transportation alternatives, minimize stream crossings, consider sensitivity to stream corridors and placement of transportation facilities).
  - Integrate transportation planning with land use planning to ensure that there is consistency in the application of ESA goals.
  - Revise transportation system plan to incorporate ESA goals.
  - Incorporate ESA goals into future transportation design activities (e.g., minimize proximity of streets, pedestrian and bike paths, bike and car parking areas to stream corridors; design "fish-friendly" bridge crossings; use "fish-friendly" construction materials).
  - Encourage businesses to provide employee bus-passes, provide bike parking, and encourage car/van pooling, off-peak hours and telecommuting.

    - Modify operations and maintenance activities to reduce impact on Chinook salmon habitat and water quality (e.g., airport maintenance, grading/sweeping, vegetation maintenance, chemical application, vehicle maintenance).
- Water Supply.
    - Add fish screens at water supply intakes.
    - Promote water conservation measures (public, private businesses and residents).
    - Adjust rates to regulate water consumption.
- Wastewater Treatment.
    - Promote planning activities that will reduce impact to Chinook salmon habitat (e.g., increase capacity of pump stations to reduce likelihood of overflows).
    - Develop a spill prevention program.
    - Require discharges from certain businesses to be pre-treated before discharge.
    - Investigate use of pump stations instead of gravity systems near waterways and high groundwater areas.
    - Incorporate operations and maintenance activities that minimize impacts to streams.
    - Consider grey water separation to decrease flow to wastewater treatment plant and to conserve water.

Similarly, for citizen behavior the following options were identified.

- Encourage appropriate vehicle maintenance activities (spill prevention, clean-up and disposal, etc.).
- Promote proper landscaping, yard care and pollution prevention techniques (disposal of yard waste, recycling, application of fertilizers, herbicides and pesticides, etc.).
- Encourage vehicle trip reduction through employee transportation coordination and use of alternative transportation modes.
- Promote water conservation activities to reduce water consumption (e.g., recycling, appliance purchase rebates).
- Develop program to educate citizens about salmon habitat protection and how they can contribute (schools, media, etc.).

Public Review

Once the initial options list was developed in the Fall of 2002, the City began a series of public reviews that culminated with a public open house/workshop on November 19, 2002 and a website-based questionnaire. The purpose of these actions was three-fold. First, they were designed so the public could review and comment on the solution options

that were identified. Second, they were designed to solicit additional options from the public. Third, they were used to gauge public acceptability and support for the solution options.

Two stakeholder meetings (October 2 and 9, 2002) were held prior to the second public open house/workshop. The stakeholders were identified from contacting environmental organizations (The Environmental Center, Mary's River Watershed Council) business organizations (Corvallis Chamber of Commerce), institutions (Oregon State University) and interested people who had registered for future contact at previous public meetings.

After a project update and overview, stakeholders were presented with the draft options and then encouraged to ask questions and comment on them, as well as identify other options or variations on the solution options. The stakeholders identified variations to the solutions options and suggested specific ways to apply the options.

The second public event (the first was held May 2001) was an open house/work shop (November 19, 2002). Attendees were presented with the options and then divided into groups to carefully review, comment on and add/modify the solution options (e.g., land use, parks and recreation, utilities, construction specifications, transportation, citizen behavior). The options were ranked in order of effectiveness to prevent Chinook salmon habitat degradation. At the end of the meeting participants were also asked to rank the options themselves based on how they perceived the City should prioritize its ESA planning efforts. A questionnaire was distributed to the attendees for that purpose.

This questionnaire was also posted for three weeks on the City's ESA project website so that persons who did not attend the public meeting could submit rankings (See Appendix 14 for copy of 11/19/03 website questionnaire). The questionnaire also included space to add comments on the options.

The first phase of review closed with the project team collecting all comments, questionnaires, and proposed new options and option modifications. Based on these inputs and those from City staff and the TAC, the project team began refining the options.

Option Refinement and Public Review

A revised set of options was prepared that incorporated the comments from the public, City staff and the TAC. Three new elements were included in the revisions. First, each solution option was screened to identify which of the 12 considerations under ESA Section 4(d) Rule Limit 12 (Municipal, Residential, Commercial and Industrial development activities) the solution met. Second, timing for implementation of the option was identified to give an idea of the lead-time and staging that might be necessary to put the option into action. Third, where possible, implementation costs were calculated.

The TAC was given several additional opportunities to review and comment on the revised options. Only minor modifications were necessary to prepare them for a final round of public comment.

The final draft set of options with revisions was presented to the public at an open house/workshop meeting on June 4, 2003. This event was similar in format to the one held on November 19, 2002. After review of the options and the modifications made based on the previous comments, the public divided into groups to carefully review the options and provide further comments and modifications. The options were listed in order of effectiveness toward preventing Chinook salmon habitat degradation. Meeting participants were again asked to fill out a survey questionnaire and provide comments based on the revised options and to change the ranking if they disagreed with the order.

The same questionnaire and comment form was posted on the City's ESA project website for four weeks to allow persons who did not attend the public meeting an opportunity to comment on the options (See Appendix 15 for copy of web-site questionnaire). Once the website questionnaire and comment form was closed, the project team assessed the public review comments and began developing the final draft solution options.

Recommended Solution Options

The following are the recommended solution options. They are presented by category and represent solutions that should prevent Chinook salmon habitat degradation and in many instances begin the process of restoring PFC. The solution options should also improve water quality, which is the most important factor in fish habitat in the Corvallis watershed. See also Appendix 9 for detailed tables of the solution options including cost estimates where it has been feasible to identify them.

Accompanying the solution options is Table 3. The table lists the solution options and indicates which of the 12 considerations under ESA Section 4(d) Rule Limit 12 the solution option meets. In some cases the solution option meets all considerations. In others the solution options meet only a few. The importance of the table is to demonstrate that the solution options when taken altogether meet all 12 considerations that are required of ESA Section 4(d) Limit 12. Not only will a program that includes these solution options comply with Limit 12, they will be effective in preventing habitat degradation and restoring PFC.

Land Use Solution Options

Zoning

Several options address changes in zoning designations that affect future land use and result in protecting Chinook salmon habitat. Some of the proposed zoning solution options are being considered under the Phase III planning effort currently underway at the City's Community Development Department. Timing for Phase III implementation is scheduled for the end of 2004.

The major components of the zoning solution options are the following.

- Protect portions of stream corridor(s) that are deemed critical to preserve Chinook salmon habitat and water quality from development through zoning. The following are examples:
  - Create protection zones and apply them at specific locations to protect habitat and water quality.
  - Create an overlay zone designed to protect Chinook salmon and water quality.
- Zoning and Open Space
  - Increase open space requirements for all zones.
- Density transfers for development:
  - Allow density transfers to increase open space.
  - Allow density transfers on-site to protect selected resource areas.
- Use resource information from Corvallis' Statewide Goals 5 (Open Spaces, Scenic and Historic Areas and Natural Resources), 6 (Air, Water and Land Resources Quality) and 7 (areas subject to Natural Disasters and Hazards) compliance projects to craft ESA protection policies and actions.
- Limit uses within zones:
  - Uses within stream corridors or on specific reaches or watersheds would have limited use depending on location.

Land Use Development Standards

Solution options are also proposed for development standards. Development standards are part of the City's LDC, which is currently being updated as part of the Phase III planning effort. Like the timing for zoning, the City intends to complete update of the LDC by the end of 2004.

The following lists the major components of proposed development standard solution options.

- Standards to decrease impervious surface. One of the biggest contributors to Chinook salmon habitat degradation is stormwater run-off from impervious surface. One method to reduce the volume of run-off is to consider reductions in the amount of impervious surface allowed in land development. The following are a few examples:
  - Reduce parking maximums where transit is available.
  - Require an increase in bicycle parking to encourage riding and reduce vehicle trips.
  - Encourage pervious pavement.

    - Reduce base ratios for auto parking.
- Modify street design standards.
    - Reduce street widths (not below emergency access widths).
    - Require bike lanes.
    - Allow one-sided street parking.
    - Incorporate "green street" design standards (e.g., use planting strips/swales for stormwater treatment).
- Require and provide incentives for vegetation protection.
    - Vegetation can be used as an effective buffer (see below) between stream corridors and development.
    - Landscaping with native species will also help reduce the impact to habitat.
- Buffer areas.
    - Adjust buffer requirements depending on the habitat quality of a specific reach. High quality reaches would have more restrictive development standards than low quality reaches in order to protect and prevent them from becoming degraded.
    - Apply greater mitigation requirements in lower quality reaches in order to prevent further degradation.
- Dedications and easements to protect riparian function.
    - Develop a formula-based approach to determine the size/width of an easement.
- Develop specific design standards for stream crossings.
    - Identify appropriate locations for stream crossings to minimize impact to water quality and fish habitat.
- Provide incentives (e.g., density transfers) to remove development within the 100-year flood plain.
- Require development standards that address wetland and other sensitive areas/lands.
- Create specific land use standards that address Chinook salmon refuge areas, if necessary.
- Prepare land development standards that are specific to the Mary's River area to take account of the unique habitat features of the river.

Parks and Recreation Solution Options

The City has a significant amount of land devoted to park and recreational facilities. Park acreage is approximately 1,439 acres of which 1,100 acres are designated open space lands. Many of these park facilities are adjacent to or along streams where park development and operation and maintenance activities can impact the quality of Chinook salmon habitat and water quality. Even park facilities that are not along streams have some potential to impact fish habitat and water quality.

The proposed solution options cover a wide range of parks and recreation activities. The activities include future park, open space, and recreational planning; specific park and recreation facility improvements; and park and recreation facility operations and maintenance. Timing for implementing the solution options varies depending on the activity and the Department's ability to fund the solutions.

Neighborhood Park Planning

A number of recommended solution options were suggested for neighborhood park facility planning. The following specific options are proposed:

- Develop new park siting, planning, and design criteria that address Chinook salmon habitat and water quality. Some examples follow:
  - Incorporate water quality sensitive design.
  - Use eco-friendly design materials (e.g., pervious pavement for trails and parking lots).
  - Site park facilities where impacts are lower.
  - Maintain surface and sub-surface flows by decreasing the amount of impervious surface, compaction and contaminants.
  - Site active recreation parks outside stream corridors.
  - Limit corridor crossings with culverts.
  - Develop park programs that balance recreation and environmental stewardship.
  - Have goals that reflect sensitivity towards ESA, fish and wildlife needs, and water quality.
  - Maintain composition and overstory cover (tree cover).
  - Maintain composition and understory cover (shrub/herbaceous layer).
  - Maintain historic water flow and hydrology where parks are adjacent to streams.
  - Minimize the need for additional stormwater treatment with proper facility design.
  - Plant native species where appropriate for mitigation and park plant community.

- Continue park policy of "right plant, right location."
- Place parks on one-side of the creek or use bridges that span the entire creek (no in water bents) to minimize impacts.
- Maintain stream corridors by designing to minimize their impact.
- Develop partnerships to acquire land or conservation easements that can be preserved as open space.

Open Space and Recreation Service Planning

Since the City is responsible for over 1,000 acres of park lands designated as open space, there is a need to address how to manage the open space as it pertains to Chinook salmon habitat and water quality. The City recognizes its role as steward for this open space and has begun developing an Open Space and Recreation Service Plan that addresses among other issues impacts on habitat and water quality. Plan development is currently underway with the Owens Farm property (located adjacent to the Jackson-Frazer Wetland) and will be expanded to other open space lands once a methodology for developing an open space plan is worked out.

Operations and Maintenance

Operations and maintenance activities can have some of the most direct impacts on fish habitat. Maintenance for parks along City streams and rivers (Willamette Park, Crystal Lakes Sports Fields/Kendall Natural Area, MLK/Berg Park, Riverfront Commemorative Park, Avery Park, etc.) have the potential to degrade habitat if not conducted properly. The following options have been identified to help reduce habitat degradation. The timing for implementing these solutions will vary depending on the availability of the budget.

- Prepare an Operations and Maintenance Manual to provide guidance for the entire parks system.
  - The Operations and Maintenance Manual would be site- and season-specific and provide guidance for all site operations and maintenance activities (e.g., vegetation maintenance, mowing, fertilizer and herbicide/pesticide applications, etc.).
  - Map parks and identify locations where specific activities may and may not take place.
- Maintenance for nearly all park and recreation equipment is performed at Avery Park. Since this park is located adjacent to the Mary's River, maintenance activities, if proper precautions are not taken, could potentially impact the river.
  - Provide guidance for the Avery Park maintenance facility, which includes containment and treatment of equipment wash-down and run-off liquids.
  - Develop a spill prevention program.

- Properly dispose of liquids and materials used for maintenance.
- Provide an appropriate facility for storing chemicals and liquids.

Existing Park and Recreational Facilities

While planning can address future park and recreational facility development, existing parks have the potential to impact Chinook salmon habitat and water quality. The following solution options are directed toward addressing the City's existing park and recreation facilities.

- Inventory existing park and recreational facilities (e.g., activities, programs, structures, locations, and operations and maintenance practices) and assess how they fit with ESA goals.
  - Determine what modifications are needed to minimize impact to fish habitat and water quality.
- Existing park and recreation solution options.
  - Mitigate activities on-site by removing/replacing structures and impervious surfaces with low environmental impact materials.
  - Retro fit and mitigate impacts with low impact design and materials.
  - Identify parks located in sensitive and riparian areas and determine mitigation needs.
  - Implement agriculture conservation plans where agriculture leases and service agreements exist.
  - Time construction to minimize erosion and sediment transfer, soil compaction, and impact to Chinook salmon habitat.
  - Use Best Management Practices (BMPs) to maintain low impact.
- BMX Track (bike park).
  - Retro fit and mitigate BMX park or move it to reduce impact on stream water quality and fish habitat.
  - Remove creosote posts.
  - Remove paved access ramp and boat structures.
- Timberhill School Park.
  - Restore wetland and mitigate drainage impacts.

- Mary's River Natural Park.
  - Install floating dock to minimize impacts.
  - Use low impact materials for facilities and structures.
- Bruce Starker Park.
  - Implement management strategy to minimize impact of ornamental pond on adjacent streams (chemicals in water have been discharged).
  - Treat discharge of stormwater (install oil separator).
  - Redesign and relocate parking lot so as not to be so close to stream.
- Wood chip pile run-off and containment (located at Avery Park) – several options.
  - #1: Develop methods to capture, treat, and discharge run-off from organic debris at existing location.
  - #2: Move the pile elsewhere to prevent discharge to Mary's River (e.g., move to Process Recovery Center).
  - #3: Reduce, restrict, or eliminate third-party organic debris to reduce potential liquid run-off.

Stormwater Run-off Solution Options

It has been determined that one of the main pathways contributing to Chinook salmon habitat and water quality degradation is stormwater run-off. The City recognizes that stormwater run-off can be a problem and has taken a number of steps recently to help reduce its impact through planning efforts and projects such as the City's successful stormwater collection, treatment and discharge project in its urban core (combined sewer overflow project). The ESA project team has carefully reviewed these efforts and has proposed solution options that capitalize on ongoing stormwater management efforts as well as proposed additional solutions that will further reduce negative impacts to Chinook salmon habitat and water quality. Some of the options are incorporated into ongoing stormwater projects, while other options will be included in future planning and capital improvement efforts.

Stormwater Planning

Control of stormwater begins with planning where it is possible to assess current conditions and forecast future conditions that incorporate such factors as population growth and the spatial distribution of land use development. From these planning efforts the City can assess ways to manage future stormwater run-off. The City has undertaken just such an effort over the past six years with development of its Stormwater Master Plan (SWMP). They have crafted major policies and identified projects that will address the City's stormwater.

The ESA project was initiated after the SWMP was well underway, but the City was extremely interested in integrating the SWMP with the ESA. The ESA project team carefully reviewed the working documents for the SWMP and provided information, as it was available, to members of the SWMP committee. From these interactions the following proposed solutions options were crafted.

- Integrate SWMP into ESA program.
  - General policies to integrate into the ESA program are in Chapter 5 of the SWMP. The policies include maintaining natural hydrologic processes, protecting and restoring natural resources and ecosystem functions; protecting and improving water quality; addressing maintenance requirements and allowing for maintenance access; incorporating community awareness and information exchange.
  - SWMP recognizes the need to integrate the SWMP policies with the ESA program through application of SWMP policies to Municipal, Residential, Commercial, and Industrial (MRCI) development, which is ESA Section 4(d) Rule Limit 12.
- Integrate specific SWMP actions into ESA program that do the following:
  - Provide sediment and erosion control requirements to reduce erosion and sediment transfer.
  - Reduce contaminant transfer to surface and groundwater.
  - Enhance native vegetation along riparian areas to maintain connectivity, filtering pollutants, provide shade, and maintain buffer.
  - Protect and enhance stream channels.
  - Protect uplands and wetlands.
  - Manage floodplains to protect development but also to maintain fish habitat.
  - Restore streams to properly functioning condition.
- Erosion Control Ordinance
  - Pass and implement Erosion Control Ordinance
- Operations and Maintenance
  - Develop stormwater operations and maintenance management plan (this is Phase II of the U.S. Environmental Protection Agency's stormwater discharge permit requirement).
- Monitoring stormwater
  - Develop stormwater monitoring plan to measure improvement in water quality in streams and creeks over time and incorporate ESA goals for preventing Chinook salmon habitat degradation.

- Focus on two elements in the monitoring program: on-site monitoring and programmatic monitoring. On-site monitoring will require taking actual site (field) measurements to determine effectiveness of program goals. Programmatic monitoring will assess how the implemented activities meet ESA goals.
- Incorporate steps and procedures for corrective actions where program does not meet improvement criteria.
- Develop community awareness and recognition that ESA salmon recovery is a long-term commitment. Changes in the landscape and water quality will take considerable time to accomplish.

Public Construction Specifications Solution Options

It is considered important that the City take the lead in demonstrating how to meet the ESA project goals of preventing further Chinook salmon habitat degradation and initiation of PFC restoration. All public construction must comply with the City's construction specifications. The project team reviewed the existing public construction specifications to identify solution options that could meet the ESA goals. In addition to actual construction, the project team has reviewed the City's commitment to sustainable development practices. The following solution options that were identified to meet the ESA goals range from job site activities and enforcement to long-term sustainability practices.

Onsite Construction Activities

The concerns with the job site are construction activities that may have off-site impacts. Not only do equipment clean up and materials disposal practices have the potential to impact nearby streams and riparian areas, but also the construction materials themselves can have long-term impacts. The following are on-site solution options that primarily address clean up and construction practices. The next section on sustainability addresses construction materials.

- Require contractor to prepare a construction site plan that addresses:
  - Appropriate disposal of construction materials (concrete, soil, construction materials).
  - Mitigation of impacts should plan fail and damage occurs off-site.
  - Appropriate disposal of demolition materials.
  - Monitoring plan to assure compliance.
  - Proper pipe flushing activities.
- On-site hazardous materials.
  - Proper use and disposal of construction related hazardous materials. Dispose of hazardous materials in a manner that does not impact water quality and salmonid habitat.

    - Require specific clean up practices for solvent materials that are used at the construction site.
- Erosion control.
    - Specify appropriate erosion control practices (see erosion control option in stormwater solution options).
    - Containment of pollution run-off (e.g., stormwater, wash-down, etc.).
    - Minimize contaminates at job site from entering streams and groundwater.
- Monitoring and enforcement of construction site plan: two methods.
    - Contractor or materials supplier performs monitoring and self-enforcement.
    - City performs monitoring and enforcement.

Sustainability

Sustainability has become an increasingly important element in development. Both public agencies and private developers are recognizing the benefits of developing projects that support environmentally sustainable concepts. One way to encourage the adoption of sustainable development practices by the private sector is for the City to use the concepts in its own construction. Another way to encourage private business to adopt sustainability in private development is to create incentives for the private sector to support sustainable development.

Sustainability with respect to protection of Chinook salmon habitat and water quality ranges from siting of facilities and use of construction materials to the actual design of a facility. The following solution options identify sustainability practices that can positively impact Chinook salmon habitat and water quality.

- Encourage construction in the City to meet LEED standards (Leadership in Energy and Environmental Design). Corvallis is currently using LEED for some of its own building practices, but these practices should be expanded to encourage incorporation of LEED in private land development and construction.
- Require "eco-friendly", low impact materials and recycling practices.
- Encourage use of materials that would reduce impact on environment, including paints, construction materials, etc.
- Consider providing a list of products that are accepted/prohibited or, alternatively, the City should define "fish friendly" criteria that contractors/suppliers can use to determine what construction materials qualify.
- Incorporate construction-siting criteria that reduce negative impacts on water quality and fish habitat (e.g., building placement, buffer areas, utility location, drainage way location, etc.).

Transportation Solution Options

Transportation (e.g., roadway network, bridges, bike and pedestrian pathways, transit, etc.) plays a critical role in almost all City activities. It is principally through the transportation network that residents and businesses connect and interact. Freight is transported, residents commute to work, to shop, and to recreate.

The transportation network is both large and pervasive. The facilities that are needed to support the network can have negative impacts on the environment including Chinook salmon habitat and water quality in streams. The purpose for identifying transportation solution options is to help minimize their negative impact through planning, project construction, and maintenance and operation activities. By incorporating the proposed solutions it will be possible to prevent further Chinook salmon habitat degradation and water quality impacts to city streams.

The solution options are divided in to three main categories — planning, design, and operations and maintenance. Transportation planning covers solutions that will help future transportation network development. Design will address projects to be constructed. Operations and maintenance addresses current and future impacts to Chinook salmon habitat and water quality.

Transportation Planning

While planning for transportation facilities is closely tied to the City's comprehensive planning efforts, determining exactly what type of transportation facilities will be needed is in part the role of the Transportation System Plan (TSP). In that capacity the TSP can address not only the types of transportation facilities to provide, but also the way they are delivered. Issues such as timing, location, design and even materials that are used can be addressed in transportation planning policies. Therefore, transportation planning is an important method of preventing future Chinook salmon habitat degradation as policies can be identified to meet ESA goals.

What follows are solution options that cover future transportation facilities. The options range from proposed policy changes to more specific design related planning.

- Incorporate ESA goals into the Transportation System Plan (TSP).
  - Review the TSP to make sure specifications incorporate habitat and water quality considerations.
  - Revise proposed projects to meet habitat and water quality requirements.
- TSP policy planning should address the following:
  - Minimize proximity of streets, pedestrian and bike paths, and parking areas to streams, creeks, water bodies and wetlands.

- Minimize impacts caused by proximity of transportation facilities to streams and water bodies through design and materials used.
- Minimize stream crossings. Where bridges are needed use open bottom structures instead of culverts and span entire streams to reduce the number of structures in streams.

- Transportation Demand Management (TDM) Strategies.
  - Identify and implement strategies in the 1995 Transportation Alternatives Study to help improve water quality, reduce stormwater run-off, and reduce impervious surface cover.
  - Reduce private vehicle trip generation by encouraging alternative transportation methods (bike, bus, carpooling, pedestrian, walking).
  - Encourage telecommuting.
  - Recommend reduction in vehicle miles traveled (VMT). As a member of the Corvallis Area Metropolitan Planning Organization (CAMPO) The City can now implement programs that encourage VMT reduction.

Transportation Design

The project team proposed solution options that can be incorporated into project design. The following solution options address specific design elements that will help prevent Chinook salmon habitat degradation. Many of these options come from the so-called Green Street design elements that address methods to meet important transportation network goals through low impact transportation improvement designs.

- Capital Improvement Plan (CIP).
  - Incorporate low impact design into CIP transportation projects.
  - Incorporate SWMP policies as part of the evaluation criteria to determine applicable low impact design elements.
- Consider incorporating the following design elements into future transportation projects. These design elements could become part of the updated TSP.
  - Modify existing street widths based on street classifications (e.g., one-side parking, one-side sidewalks).
  - Consider bio-swales and other vegetative buffers to prevent run-off to streams along streets and in parking lots.
  - Consider alternative materials (e.g., pervious materials, vegetation, etc.) in project designs.
  - Consider vegetation planting wherever possible to reduce temperature and evaporation.

- Incorporate capture and treatment techniques to reduce the impact of stormwater run-off.
- Reduce the City's current off-street parking space ratio from 1:400 square feet of floor space to 1:1,000 square feet of floor space.
- Use concrete instead of asphalt to reduce run-off temperature.

Street Operation and Maintenance

The City's transportation operation and maintenance activities are quite advanced. Many operation and maintenance activities already minimize impacts to streams. The City is considering a similar application to NOAA Fisheries for an ESA Section 4(d) Rule Limit specifically for its transportation operation and maintenance practices. Limit 10 of the Section 4(d) Rule covers Routine Road Maintenance Activities. Like Limit 12, if approved by NOAA Fisheries, the operation and maintenance activities performed by the City's transportation division will be certified as protecting Chinook salmon habitat.

A letter from NOAA Fisheries dated January 7, 2002, which addressed Phase I of Corvallis' ESA project, encouraged the City to consider submitting a Limit 10 application. In part the letter noted "we [NOAA Fisheries] recommend the city consider submitting an application under the 4(d) limit for your road maintenance program (Limit 10)."

Further, the letter from NOAA Fisheries acknowledged that the level of effort to obtain approval for a Limit 10 is less arduous than for a Limit 12. While the Limit 12 may cover a broader number of activities, the Limit 10 is a good start to meeting the ESA requirements for Chinook salmon habitat preservation.

Water Supply Solution Options

Water supply impacts on Chinook salmon habitat typically occur in three ways. First, there is the raw water intake where water is pumped from the Willamette River to eventually be delivered to the user. Second, there is the consumption of the water by the user. Third there are the activities that the City must perform to maintain the water supply system.

In the first instance, water withdraw from the river has the potential to result in a direct take of Chinook salmon should they be sucked into the raw water intake. In the second instance, there is a potential of indirect take if water applied to land acts as a pathway for contaminants such as lawn fertilizer, to enter a stream and degrade Chinook salmon habitat. Finally, in the third instance there are maintenance activities such as waterline flushing that can result in habitat impacts. All three can violate the ESA for listed Chinook salmon.

Fortunately, the City has already undertaken efforts to eliminate take at the City's raw water intake. The City installed a NOAA Fisheries approved water diversion fish screen to reduce the possibility that Chinook salmon will enter the water intake. An approved water diversion screen by NOAA Fisheries complies with ESA Section 4(d) Rule Limit 9. Limit 9

specifically addresses water intakes and appropriate screening to prevent the take of listed fish.

With respect to the second and third areas of potential impact there are a number of potential solution options that can help reduce habitat degradation. The following options have been proposed to address water consumption and system maintenance.

Water Consumption

Reducing water consumption can be a way to lower the potential impact on Chinook salmon habitat. A reduction in water demand will lower water needs for the Corvallis system, which in turn will reduce the risk of a take at the City's water intake and leave more water in the Willamette River. Water conservation may also result in a reduction of the need for water to be applied to landscaping and other land features, which can lead to Chinook salmon habitat impacts. The following proposed options address ways to encourage water conservation.

- Conservation measures.
  - Encourage public and private business conservation measures to reduce water consumption through education programs.
  - Use inclining rates to reduce water consumption.
  - Investigate the use of appliance rebates to encourage conservation.
  - Encourage use of native vegetation to reduce irrigation needs.

Operation and Maintenance

The City must maintain its water supply system. Most operations and maintenance activities already prevent impacts to streams. A few additional solution options have been proposed that will further reduce impacts.

- Consider reducing the amount of water needed for flushing the distribution system and blow-off to reduce water supply demand.
- Quickly replace or repair broken or damaged pipelines.
- Provide secondary containment for spills that could contaminant streams.
- De-chlorinate backwash water.

Wastewater Treatment Solution Options

There are a number of areas where wastewater has the potential of impacting Chinook salmon habitat. Upsets can occur and untreated wastewater can be discharged directly into the Willamette River when combined sewer and stormwater flows overwhelm the collection system and treatment facility's ability to treat the volume (fortunately, recent projects have substantially reduced the frequency of this occurrence). Gravity collection

systems are often located along side streams where they can impact stream surface and underground water flows. Treated wastewater discharges have the potential to elevate receiving water temperatures. In addition, as city growth occurs there are increasing collection, treatment and discharge capacity needs to handle the growth creating potential future impacts on habitat and water quality.

The project team has identified a number of solution options that can reduce Chinook salmon habitat impacts. Like water supply, some of the solution options are related to activities that can reduce demand or the need for treatment capacity through planning and other reductions in capacity needs. Other options address maintaining the existing system so there is a lower probability of upsets or overflows.

Wastewater Collection

The following are proposed options to help reduce the potential for system upsets. They address both maintenance as well as conservation techniques.

- Increase capacity of pump stations to reduce likelihood of overflows. Install auxiliary power source.
- Disconnect stormwater drains on private and public facilities from the sanitary sewer system.
- Regular inspection of pipes to verify integrity.
- Repair or replace damaged and broken pipes.
- Flush and clean pipes to maximize capacity.
- Enforce the fats, oils, and grease (FOG) program to reduce grease build-up in pipelines, which reduce their capacity to convey wastewater.

Conservation

Conservation can help reduce wastewater treatment capacity demand. Like water supply conservation, reductions in demand can have a number of benefits to Chinook salmon habitat including lower discharge, fewer new facilities and reduced risk of system upsets. The following solution options address methods that can lead to reduced treatment capacity demand.

- Investigate use of grey water separation to decrease flow to wastewater treatment plant and to conserve water.
- Investigate wastewater reuse.
- Encourage citizen and business conservation measures to reduce wastewater discharge.

Discharge

The City has a National Pollution Discharge Elimination System (NPDES) permit that allows it to discharge treated wastewater into the Willamette River. The permit specifies the requirements for discharge including volumes, temperature, quality and allowable mass load limits. The City is seeking a renewal for the NPDES permit in 2004. During renewal the following proposed solution options should be considered for the new permit.

- Incorporate temperature requirements for Chinook salmon in upcoming NPDES permit.

Citizen Behavior Solution Options

Citizens should be considered partners in any ESA plan that is developed. Corvallis residents and businesses are known for their support of civic activities and environmental preservation. In many instances citizens and businesses are already incorporating behaviors that support Chinook salmon habitat and water quality. These activities include recycling, use of alternative transportation modes, telecommuting, water conservation, planting native vegetation and other low water use plants, and supporting other pollution prevention activities.

The following proposed solution options capitalize on the predisposition of citizen and local business behavior. In addition, with some strategic support by the City (using staff time to help implement some of these activities) the activities could have a noticeable impact on protecting Chinook salmon habitat.

Public Education

Informing and educating the public on the purpose and goal of protecting Chinook salmon habitat is an important step in changing citizen behavior. To be successful, though, it needs to be a coordinated program with sufficient resources to promote the educational effort. The following proposed solution options address public education outreach efforts.

- Develop a formal Public Education Plan and include the following elements:
  - Outline program and activities/elements to be used to encourage changes in public behavior.
  - Provide overall guidance and direction on public education.
  - Include program elements, milestones and evaluation criteria to measure effectiveness.
- Coordinate with other ongoing programs.
  - Use Public Works Department Water Resources Specialist to organize public education plan in coordination with other water quality initiatives.

- Use other existing programs to educate public on what they can do to contribute to preserving Chinook salmon habitat and maintaining water quality. Existing programs would include the Parks and Recreation Department's Urban Forestry program and Public Works Department's water conservation programs.
- Prepare, print and distribute brochures on recycling and conservation.
- Enlist other non-city organizations and programs to help educate the public (e.g., Master Gardener Program, Chamber of Commerce, Environmental Center, neighborhood associations, Mary's River Watershed Council, etc.).

- Pollution prevention program (PPP). This program has similar goals and can be a useful tool for the ESA education program.
  - Public Education Plan would reference the PPP as part of the City's overall effort.
  - Encourage both citizens and businesses to participate.
  - Existing PPP is currently being updated and expanded to meet Clean Water Act (CWA) requirements.

Incentives

Incentives can encourage voluntary participation. The following address goals that can help achieve the ESA goal.

- Support incentives to change citizen behavior. Incentive programs could be an element in the Public Education Plan. The following programs will help to reduce water demand and water quality degradation:
  - Low water use appliance rebates.
  - Recycling programs including yard waste.
  - Water conservation programs.

Landscaping and Yard Maintenance

Appropriate landscaping can help conserve water, shield and buffer riparian areas, and reduce stream contamination. Similarly, appropriate yard maintenance techniques can reduce stream pollution and contamination. The following proposed solution options address some of the major landscaping and maintenance elements.

- Encourage appropriate landscaping activities.
  - Develop landscaping education programs as an element of the Public Education Plan.
  - Use native species and low water use plants.
  - Reduce chemical application.
  - Recycle yard debris.

    - Increase use of pervious materials on residential lots.
- Encourage citizen protection of riparian areas.
    - Riparian area preservation education would be an element in the Public Education Plan.
    - Encourage volunteering to help clean up riparian areas and planting native vegetation.
    - Encourage stewardship programs.

Vehicle Maintenance

Encouraging proper maintenance techniques will reduce the possibility of contamination entering local streams.

- Include a Vehicle Maintenance Program as part of the Public Education Plan.
    - Encourage households and businesses to use appropriate disposal/recycling of vehicle maintenance fluids and equipment.
    - Encourage use of spill containment for home and business auto repairs.

Household

While there is a lower risk that household cleaning and maintenance activities can impact local streams, encouraging the use of low impact household chemicals can further reduce that risk. The following proposed solution option can become a part of the Public Education Plan.

- Encourage use of "fish friendly" or low impact non-toxic household cleaners/chemicals. Many household chemicals dumped down sewers cannot be effectively treated and are discharged to the Willamette River.

CONCLUSION

This chapter addresses the process used to develop the proposed solution options. The solution options are the culmination of Phase I, development of the baseline conditions, and Phase II, assessment of city activities and citizen behavior on the existing conditions.

Actual and potential impacts to the existing habitat and water quality conditions have been quantified and ranked. From this process solution options unfettered by any conditions or restrictions have been identified in order to obtain the widest possible number of solutions that could meet the ESA compliance requirements.

Through a rigorous process of review by City staff, the TAC, and the public, the initial solution options were screened and reduced. The final draft set of solution options cover a wide range of activities that meet the ESA Section 4(d) Rule Limit 12 compliance requirements.

Table 3. Considerations and Solution Options Matrix

Solution Option	LIMIT 12 CONSIDERATIONS											
	1	2	3	4	5	6	7	8	9	10	11	12
	Avoid inappropriate Areas (e.g., slopes, wetlands, high habitat value)	Prevents stormwater discharge impacts on water quality & quantity & stream flow patterns in watershed.	Protects riparian areas well enough to attain or maintain PFC	Avoids or minimizes impact of stream crossings (e.g., roads, utilities, linear development) wherever possible.	Adequately protects historic stream meander patterns & channel migration zones & avoids hardening stream banks/shorelines	Adequately protects wetlands, wetland buffers & wetland function – including isolated wetlands.	Adequately preserves permanent & intermittent streams' ability to pass peak flows.	Stress landscaping with native vegetation to reduce the need to water & apply herbicides, pesticides, & fertilizer.	Provisions to prevent erosion & sediment run-off during (& after) construction, prevents sediment & pollutant discharge to streams, wetlands, & other water bodies.	Ensures demands on water supply can be met without affecting the flows that threatened salmonids need.	Provides mechanisms for monitoring, enforcing, funding, reporting, and implementing its program. Formal evaluations to take place every 5 yrs.	Complies with all other state & Federal environmental & natural resource laws & permits.
Land Use												
Zoning	X	X	X	X	X	X	X	X	X	X	X	X
Development Standards	X	X	X	X	X	X	X	X	X	X	X	X
Park & Recreation												
Neighborhood Park Planning	X	X	X	X	X	X	X	X	X	X	X	X
Open Space & Recreation Service Plan	X	X	X	X	X	X	X	X	X	X	X	X
Capital Improvement Plan	X	X	X	X	X	X	X	X	X	X	X	X

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Park O&M Manual		X	X			X		X	X		X	X
Park Inventory	X	X	X	X	X	X	X	X	X	X	X	X
Existing Parks		X	X			X		X			X	X
Park Construction Retrofit	X	X	X	X				X	X	X	X	X
Mini Parks	X	X	X	X	X	X	X	X	X	X	X	X
Specific Parks	X	X	X			X		X	X	X		X
Equipment Maintenance		X										X
Organic Debris Disposal		X				X			X		X	X

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Construction Specifications On-site Construction Activities		X	X			X		X	X		X	X
Construction Site Enforcement			X			X			X		X	X
Hazardous Materials		X							X			X
Pipe Commissioning		X							X			X
Erosion Control Ordinance		X	X		X	X	X		X		X	X
Sustainability	X	X	X	X	X	X	X	X	X	X	X	X

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Transportation												
Planning Elements	X	X	X	X	X	X	X	X	X	X	X	X
TDM			X	X		X					X	X
Transportation System Plan	X	X	X	X	X	X	X	X	X	X	X	X
CIP	X	X	X	X	X	X	X	X	X			X
Design Specifications		X				X		X	X			X
Routine Rd. Maintenance - ESA Limit 10		X		X		X			X		X	X

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Stormwater												
Planning & CIP	X	X	X	X	X	X	X	X	X	X	X	X
Erosion Control Ordinance		X	X		X	X	X		X		X	X
O&M		X	X			X		X	X			X
Monitoring											X	X
Wastewater												
Wastewater Treatment											X	X
Facility Oils & Grease Program											X	X

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Wastewater Collection,	X			X		X			X		X	X
O&M						X			X		X	X
Master Plan and CIP	X	X	X	X	X	X	X	X	X	X	X	X
Discharge						X					X	X
Water												
Water Supply Conservation								X		X	X	X

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Water Intake										X	X	X
Distribution	X			X		X			X	X	X	X
O&M						X			X		X	X
Citizen Behavior												
Public Education Involvement	X	X	X	X	X	X	X	X	X	X		
Incentives		X	X			X		X		X		

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Pollution Prevention	X	X	X		X	X	X	X	X	X	X	X
Landscaping			X		X	X	X	X		X		
Household		X	X					X	X	X		X
Vehicle Maintenance		X	X									X
Riparian Areas		X	X		X	X	X	X	X	X		X